

Environmental

CLEANUP

Jet Propulsion Laboratory Information Sheet

January 1996

GROUND WATER

The water in the ground beneath our feet is a valuable resource that we often take for granted. In fact, ground water serves as an important source of

potable water for many commu-

Ground WATER nities in our area, including Pasadena, La Cañada-Flintridge, San Marino, Sierra Madre, Altadena, Alhambra, and

Arcadia. This information sheet introduces some of the important concepts in ground-water hydrology by exploring how ground water moves through the subsurface.

Contrary to popular belief, water does not often move in the subsurface through underground rivers or streams. Most of the time, ground water is confined to the very small amounts of open space found in rock and soil. Sometimes this open space is caused by fractures within solid rock such as granite, but usually it is simply the small amount of open space between the gravel, sand, and silt that make up the soil.

The illustration below shows what this open space, called *porosity*, might look like in a typical soil. No-

GROUND WATER IS A VALUABLE RESOURCE FOR MANY OF THE COMMUNITIES IN THE JPL AREA

tice that because of their shape, sand grains cannot quite pack together tightly, thereby forming porosity. This seemingly small amount of open space is where most water is stored in the subsurface.

Porosity alone, however, does not necessarily make for a good water-bearing material. It is important that the open spaces in the rock or soil be connected to each other. This property is called *permeability*. In a permeable substance, water can easily flow from one open space to the next. For example, a sponge is very porous and permeable, thus lots of water can flow through it easily. A styrofoam coffee cup is also very porous, that is, it contains lots of air space, yet fortunately, it is not very permeable.

Water in the subsurface can be found either as soil moisture, where the pore space is only partially filled with water, or as ground water, where soil porosity is completely filled with water. This latter part of the subsurface is referred to as the *zone of saturation*. A body of rock or soil that is porous, permeable, and contains ground water is called an aquifer.

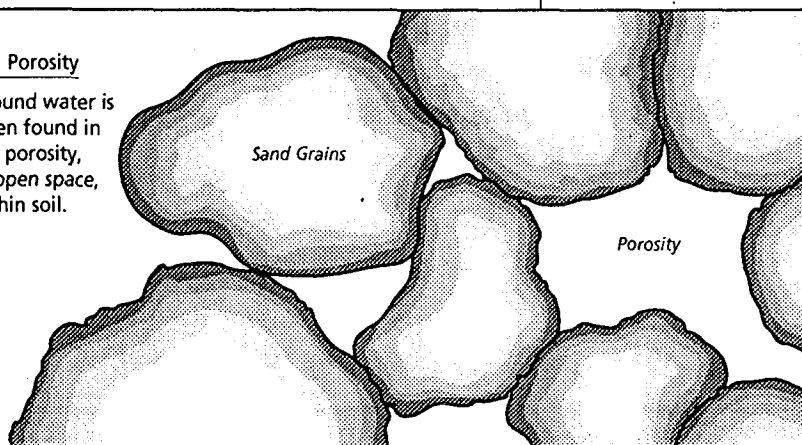
Water TABLE

The top of the zone of saturation is known as the *water table*, and can rise and fall depending on how much water is in the aquifer.

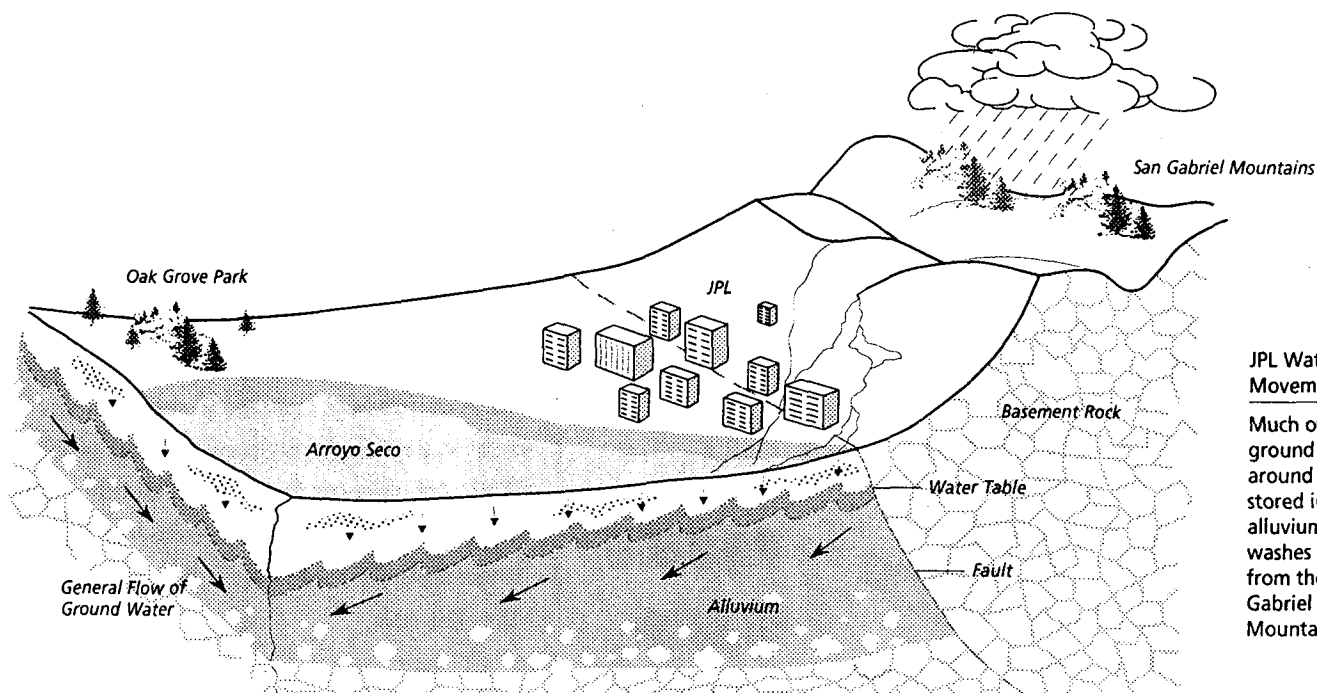
In and around JPL, most of the ground water is stored in loose sand and gravel, called *alluvium*, which has washed down from the San Gabriel Mountains north of the Laboratory. Because of its relatively high porosity and permeability, this alluvium makes a good aquifer. Underlying the alluvium is solid, granite-like "basement" rock that has very low porosity. The thickness of the alluvium on top of the basement rock can range anywhere from zero feet in the mountains to over 1000 feet in some places near JPL.

Soil Porosity

Ground water is often found in the porosity, or open space, within soil.



GROUND WATER



JPL Water Movement

Much of the ground water around JPL is stored in the alluvium that washes down from the San Gabriel Mountains.

The sketch above presents a generalized picture of the alluvium, basement rock, and water table underneath JPL. Drilling has shown the depth of the water table to be between 100 and 240 feet below the ground surface.

W a t e r MOVEMENT

Monitoring of water wells also indicates that this depth varies greatly depending on the amount of rainfall in the area, the amount of water in the Arroyo Seco, and the amount of ground-water pumping.

In addition to knowing the depth, extent, and behavior of the water table, it is important to understand how ground water moves in the subsurface. Surface water always flows downhill, or *down slope*. However, ground water always flows *down gradient* — not necessarily in the same direction as the surface water flow.

For example, the land that JPL is built on generally slopes to the south. Most of the time, ground water flows to the southeast, toward the Arroyo Seco (see the illustration). However, after periods of high rainfall, the direction of ground water beneath JPL reverses and flows toward the northwest. This occurs because stream water infiltrating down through the alluvium in the Arroyo Seco creates a source of ground water that reverses the ground-water gradient.

This example illustrates some of the complexities involved in understanding how ground water moves in the subsurface. Knowing the depth of the water table, the characteristics of the ground-water aquifer, and how water moves through that aquifer are important elements to consider in an environmental cleanup project.

SUPERFUND INFORMATION

For information on the environmental cleanup effort at JPL, and for ideas on how you can become involved, please contact:

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